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Global Assessment of Urological Endoscopic Skills (GAUES): development and validation of a novel assessment tool to evaluate endourological skills

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Abstract

Objective

To develop and evaluate an assessment tool for endourological skills during simulation including cystoscopy, ureteroscopy and transurethral resection procedures.

Methods

We designed a Global Assessment of Urological Endoscopic Skills (GAUES) tool with a 9-point endourology task-specific skills and 2-point global rating skills. The tool was developed through two rounds of the Delphi process. The GAUES tool was used to assess acquisition of ureteroscopic and transurethral resection (TUR) skills of novices (Year 2 core surgical trainees, CT2) and intermediate level trainees (residents at the start of the UK higher surgical training programme in Urology , Speciality Trainee Year 3, ST3) at the Urology Simulation Boot camp (USBC) between 2016-2018. Validity was evaluated by comparing scores between trainees with different levels of urological experience. Interrater reliability was also assessed.

Results

We evaluated 130 residents, 52% of trainees were at intermediate stage of training and 39% were novices. Nine percent of the anonymous forms were missing demographics. The completion rate of the GAUES tool during the USBC for ureteroscopy and TUR was 85% and 89% respectively. Our analysis demonstrated a significant difference in all domains between intermediates and novices at assessment in ureteroscopy, except for one domain more suited to clinical

assessment (p=0.226). There was excellent intraclass correlation overall between the two experts' judgements, ICC = .841 (p < .0001, 95% CI: 0.767, 0.893, n=88).

Conclusions

We have developed a novel assessment tool for cystoscopic, ureteroscopic and transurethral resection skills. Overall, we demonstrated good face, content and construct validity and excellent reliability, suggesting that the tool can be useful for endourological skills assessment.

Introduction

Common endourological procedures taught in the simulation setting are cystoscopy, ureteroscopy and transurethral resection of the prostate and urinary bladder to augment learning in an operating theatre setting [1]. Competency in endourological skills is a mandatory requirement of specialist urological training [2]. Assessment of competency requires the appraisal of knowledge, skills, attitudes and beliefs in a qualitative and / or quantitative manner [3]. Assessment of longitudinal learning during simulation and documentation of milestones to achieve competence requires validated tools. However, the expansion of simulator technology for endourology is far ahead of the development of tools for assessing these acquired skills. Assessment of technical skills acquisition is an essential part of training because it documents progress, ensures milestones are reached and helps in providing constructive feedback. An objective structured assessment of technical skills (OSATS) is a renowned tool commonly used to appraise the performance of generic technical skills of trainees [4-6]. Studies have proposed that OSATS should be complemented with a global rating scale of overall performance and should include a procedure-specific checklist [4,7]. Speciality-specific examples include the Global Assessment of Gastrointestinal Endoscopy Skills (GAGES; Upper Endoscopy (GAGES-UE) and Colonoscopy (GAGES-C)) created to assess simulation training in gastrointestinal endoscopy. This tool has been shown in a multicentre trial to be a reliable and valid method to measure competence [8]. There is, however, a lack of single, simple, multi-procedure validated evaluation tools in endourology to allow for objective and reliable assessment of basic or intermediate endourological skills

during simulation [6]. By designing a validated tool for the assessment of these skills, the quality of training, assessment and delivery of these procedures-specific skills training may improve.

The objective of our study was to

1. develop a simple objective scoring assessment tool applicable to cystoscopy, ureteroscopy and transurethral resection procedures during simulation training (Global Assessment Urological Endoscopic Skills [GAUES]).
2. assess the performance of this assessment tool and validate during simulation training at the Urology Simulation Bootcamp Course (USBC) [9].

Materials and Methods

This study was developed over three phases; phase 1 - selection and adoption of metrics from GAGES suitable for the development of GAUES and endourological skills assessment, phase 2 – the Delphi methodology to achieve consensus, and phase 3 - validation of GAUES during simulation training at the USBC. Ethical approval was sought from the St James's University Hospital Research and Ethics committee. Since patients or patient data were not involved in this study, ethical approval was not required.

Phase 1 - Design and development of GAUES

The Society of American Gastrointestinal and Endoscopic Surgeons have developed an assessment tool for endoscopic skills. The assessment tool consists of a 10-item global rating scale (total score 50) and examines various aspects of the endoscopic procedures including introduction of the scope, views, navigation, use of instruments and quality of examination [8]. We modelled the GAUES assessment tool based for gastrointestinal endoscopy and attempted to include assessment for three common urological endoscopic procedures (cystoscopy, transurethral resection and ureteroscopy).

We constructed a list of key nine task-specific steps required to perform basic endourological procedures. The vital steps were identified following review of the Intercollegiate Surgical Curriculum Programme (ISCP, the U.K. body overseeing the

curriculum and assessment of specialty trainees in all surgical specialties) and discussion amongst a core group of consultant endourologists recruited by the principle investigator for the USBC [9,10]. Each key step and measurement metrics noted from these sources were included in the original design of the GAUES (Supplementary file, appendix 1).

Phase two - Consensus through Delphi method

A modified two-round Delphi technique was used to obtain expert consensus on items to be included in the GAUES tool [11]. Our first draft was tested during our local ureteroscopy course in January 2013 and 2014. A non-probability sampling technique was used to select the expert panel [12]. Experts were given the initial version of the GAUES score and were requested to use the scoring system during simulated ureteroscopy training and rate the trainees' performance. This allowed experts to critique the rating scale usefulness in real-time and subsequently make changes to the domains with the initial tool.

A further refinement was evaluated by core members of the USBC faculty in 2015. For each step, we asked experts to rate the steps as described by Lefroy *et al* (Supplementary File, appendix 2) [13]. A free text box with each step allowed experts to provide written feedback on how to improve the GAUES tool. As described in many Delphi studies, we considered ≥70% agreement ("very relevant and succinct" or "relevant but needs minor alterations" responses) or disagreement (the "unable to assess relevance" or "Not relevant" responses) for inclusion or exclusion in the second round [14,15].

For the second round of the Delphi questionnaire in 2016, we addressed the comments provided by the experts within the free text column. The revised version was evaluated again in the similar fashion described in round one. In addition, on this occasion experts were asked to assess the "applicability" of the tool (Supplementary file, appendix 3).

The agreed design of the GAUES tool consists of nine-point endourology-specific skills rated on a 5-point descriptive scale, and two-point global rating skills-specific on a 4-point scale. We modelled endourology-specific skill steps on the Dreyfus model [16] of skill acquisition with "1" representing the novice level, "3" representing

the competent level, and “5” representing the expert level of endourological skill performance (Table 1).

a. Scope handling (U-IT1, -IT2, -IT3) – The first three items evaluate introduction of the endoscope and its manipulation. In addition, use of irrigation to keep the field clear and patient comfort during flexible cystoscopy if assessed in a clinical setting.
b. Examination quality (U-IT4, -IT5, -IT6) – Item 4-6 reflects attention to the important anatomical landmarks, completeness of examination of the mucosal surfaces of the organ in question (prostate/bladder/ureter/kidney) and interpretation of abnormal findings.
c. Therapeutic skills (U-IT7, -IT8, IT9) – The final three items evaluates a trainees ability to select the correct accessory for the specific examination for example correct size laser fibre for stone fragmentation, appropriate biopsy forceps for cystoscopy/ureteroscopy, use of diathermy during prostate resection, and the ability to perform a complete procedure (either cystoscopy, stone fragmentation or prostate resection).

Phase 3 - Validation of the GAUES

The validity of the GAUES was measured in several ways. Face and content validity were used to validate the assessment tool by experts. Basic steps required for these skills on the ISCP were used as a basis to develop the tool [10]. The experts focused on qualitative issues of face validity (does the content of the tool appear to be suitable to its objectives?). Content validity looked at whether the tool seems to be suitable to its aims. Construct validity was evaluated by using the GAUES tool to assess technical skills during ureteroscopy with two different groups; “Intermediate” level trainees were defined as residents at the start of speciality urology training, ST3 in the U.K. “Novice” level trainees were defined as participants in core surgical trainees year two (CT2) and below. Intraclass correlation (ICC) was assessed by comparing agreement between two experts’ judgement (one expert trainer and expert observer) on the performance of eight trainees during ureteroscopy on GAUES.

Training Tasks

The structure of the endourological skills training sessions has remained consistent throughout the lifetime of the USBC [9]. The ureteroscopy module covers the basics of cystoscopy, ureteral stent insertion technique and instrumentation relating to rigid and flexible ureteroscopy (different types of ureteroscopes, laser settings, guidewires, stents, ureteral catheters, baskets and optics). Scenarios of cystoscopy, stent insertion, laser disintegration and stone extraction were performed on synthetic models (Cook Medical, Bloomington, Indiana, USA) and virtual reality simulators (UroMentor™, 3D Systems, USA). Rigid and flexible ureteroscopy exercises were completed on both models and participants' baseline performance at the start of the module was rated using the GAUES score. The scoring was repeated during the final assessment which followed the training, while performing the same exercises on both models.

The transurethral resection module (Transurethral resection of the prostate [TURP] and transurethral resection of bladder tumour [TURBT]) comprised of familiarisation with instruments required (and their assembly) for prostate resection, irrigation fluids and energy types, description of resection techniques, depiction of anatomical landmarks, explanation of surgical complications (TUR syndrome, prostate capsule perforation) and methods to avoid, identify and manage complications arising [17]. Participants performed TURBT and TURP on the Samed model (Samed, GmBH, Dresden, Germany) and virtual reality simulators (TURP Mentor™, 3D Systems, USA) and also practiced bladder washout techniques. Unblinded baseline and assessment scores were collected for all trainees. Participants were expected to perform five ureteroscopic procedures (rigid and flexible) and five transurethral resection of prostate procedures, all including basic cystoscopy steps during the training session. A subset of trainees at the USBC also performed self-assessment using GAUES in ureteroscopy and TURP with an expert assessment held concurrently.

Statistical analysis

Data were statistically analysed using IBM SPSS Statistics Version 26. The Mann–Whitney U test was used to assess differences between novice and intermediate level trainees. Paired sample T-test was used to assess mean differences in total

itemised skill ("U-IT-1 to "IT-9") on the ureteroscopy and TURP model before and after training. The Wilcoxon signed-rank test was used to assess differences in matched assessment scores pre- and post-simulation training, and between trainee self-assessment and expert assessment scores. A Bonferroni correction was applied to the number of hypotheses corrected (corrected significant p value of 0.05/9=0.018). Interrater assessment reliability was evaluated using ICC. Guidelines for evaluating the level of agreement among scores were >0.80(excellent), 0.60-0.80 (good), 0.40-0.60 (fair) and <0.40 poor correlation [18].

Results

The Delphi process

Eleven experts (five from the TURP module and six from the ureteroscopy module) were involved in the first Delphi round (Supplementary file). Experts in the TURP module felt that steps U-IT1, U-IT3, U-IT9 were not relevant to resection procedures and suggested clarity on the descriptive scale for UT1-8 as explanation for why scores of 2 and 4 were not given. Responses from the ureteroscopy module experts were very positive. The sub-category U-IT3 was felt to be less useful on a bench-top model, however, can be used with "virtual reality" models such as UroMentor which offers additional simulation with fluoroscopy. U-IT4 was considered "relevant but needs minor alterations" by eight and "very relevant" by three experts due to wording. One expert commented that trainees' awareness of potential risk areas (capsule perforation) should be added to the rating score "5" in section U-IT8.

Seventeen experts were involved in the second round (ten from the ureteroscopy module and seven from the TURP module) with the revised version. Agreement as to the relevance of the individual steps was >80% apart from U-IT3. There were four comments suggesting that the tool would also be useful to assess trainees in an operating theatre. Six experts did not respond to U-IT9 and one expert suggested to add assessment of awareness of radiation doses. A competency level (1-5), modified from the ISCP Global performance score was added to the tool. A final assessment tool was developed with a 9-point step-specific and 2-point global skills.

The scoring system was devised with expert consensus fulfilling the face and content validity.

We also examined the "ease" of application of the assessment tool during the simulation training. Nine experts looked at the usefulness and implementation aspects of the assessment tool. Eight experts felt that the GAUES tool differentiates different steps of endourological skills and is a valuable training assessment tool. Seven experts were of the opinion that the GAUES tool covers basic endourological skills and all reported its role in quality assessment and improvement. Furthermore, all felt that the system can be used to assess cystoscopy, transurethral procedures and ureteroscopy (Figure 1).

Validation of the GAUES tool

A total of 130 trainees attended the USBC between 2016-2018. There was missing completed GAUES data from four trainees. In total, there was completed data from 126 trainees (2016 – 33, 2017 – 45, 2018 – 48). Approximately 52% (65/126) of trainees* were intermediate and 39% (49/126) were novices. Five trainees were from overseas residency programs, and grade of trainee was missing from seven participants. The average completed response rate of the GAUES for ureteroscopy and TURP was 85% and 89% respectively (Figure 2).

Ureteroscopy - Comparison between baseline and final assessment in ureteroscopy showed a significant improvement in the majority of domains (Figure 3, IT1, IT2, IT5, IT6, IT7, IT8, IT9, GA1 and Final grade – $p<0.001$) for all trainees. Our analysis demonstrated a significant difference in all domains between intermediate and novices at assessment, except for U-IT3 ($p=0.226$) which reflects an excellent construct validity.

Transurethral resection - A significant improvement was noted in GAUES score for TURP performance following training on TURP Mentor™ and SAMED models in the majority of domains (Figure 4: U-IT1, U-IT2, U-IT, U-IT5, U-IT6, overall performance – $p<0.001$). Comparison of intermediate and novice trainees showed a significant difference in IT1, IT2, GA2 at baseline, however only in one domain (U-IT7 – $p=0.007$) a significant difference was observed at final assessment. An overall

significant improvement in performance was noted for novices and intermediate trainees pre- and post-training on both intermediate endourological skills {(TURP – Mean difference = 3.5, 95% CI [2,5], p=0.000) (URS – Mean difference = 3.6, 95% CI [3,5], p=0.000).

Cystoscopy and stent – The GAUES tool was used to evaluate16 trainees. We did not collect any baseline data as most trainees had a reasonable experience of the procedure and it would be difficult to show any improvement. The assessment form completion rate was 100% (Supplementary file, appendix 4). Excellent compliance from the faculty was noted. One expert suggested that the assessment of complex stenting may be difficult.

⁎*All UK medical graduates undertake a two-year foundation programme, comprising of Foundation Year one (FY1) and two (FY2), which acts as a bridge between undergraduate medical training and core surgical/medical training. On completion of FY2, trainees undertake a two-year **C**ore Surgical **T**raining (CST) post, in which they are expected to pass the Intercollegiate Membership of the Royal College of Surgeons (MRCS) examinations. On completion of CST, trainees undertake Higher **S**urgical **T**raining (approximately six years; ST3-ST7) in one of the ten surgical specialties.

Intraclass Correlation (ICC)

Intraclass correlation was run to determine if there was agreement between two experts' judgement on the performance of eight trainees during ureteroscopy on GAUES. This provided 88 data points and is ample to demonstrate an excellent ICC. There was excellent overall agreement between the two experts' judgements, ICC = .841 ($p < .0001$, 95% CI: 0.767, 0.893, n=88). Weighted kappa test was 0.846 ($z = 7.97$, $p < .0001$). There was no significant difference between trainee self-assessment and expert assessment on ureteroscopy or TURP ($p>0.018$).

Discussion

In this study we developed and validated a Global Assessment of Urological Endoscopic Skills (GAUES) scoring system for assessment of ureteroscopy and transurethral resection endourological skills during simulation training. It was felt by our cohort of experts that one assessment tool which could be used for a number of basic endourological procedures would be preferable to multiple individual tools for each different procedure, especially in a simulation environment. Consensus for important endourological steps was achieved with two rounds of the Delphi questionnaires. We feel that U-IT1 to 9 incorporates assessment of important task-specific steps for cystoscopy, ureteroscopy and transurethral procedures and the "basic endourological" applicability was supported by assessors. The GAUES scoring system allows an assessment of fluoroscopic exposure during training with VR simulators and this aspect of the tool may be useful in a theatre setting. A trainee's response to the patient's discomfort during a flexible cystoscopy or transurethral resection procedures under spinal (due to missed bladder perforation/ excessive fluid absorption) can be evaluated with the U-IT3 category. In addition, future VR simulators in urology may have an option similar to the "GI Mentor" to assess patient discomfort during simulation [19]. Our study demonstrates good content and construct validity by incorporating recognised key steps with a significant difference between two levels of trainees with ureteroscopy with excellent interrater reliability between two independent trainers. It can be questioned that only a small cohort of 8 participants were involved in the reliability assessment. However, our number of observations was 88. As the total number of observations made by each subject increases, the minimum sample size required will decrease [20,21]. It must be stated that controversy exists in the literature regarding how reliability and validity should be measured, and the statistical approaches selected can affect the results [22].

A number of methods can be incorporated in the training program to assess performance and competence. Assessment of any form is a labour-intensive process, especially in evaluation of surgical performance. A number of different assessment tools have been described. Most commonly used are Procedure Based Assessment (PBA), Direct observation of procedural skills (DOPS) and Objective Assessment of Technical Skills (OSATS). PBA essentially encompass a ternary

system for assessing trainees' performance with unassessed (U), development required (D) and satisfactory (S) [23]. However, we feel that a numerical scale (5, 7 or 10-points) offers more freedom and allows a better measure for improvement due to the fine differentiation of the ratings. Furthermore, DOPS are non-specific procedural based analysis of a trainee's performance, without any standardisation in performing task-specific steps competently. The evidence for validity and reliability of DOPS and PBA is limited [24-26].

Assessment during simulation may include automated simulator matrix, observations tools and motion analysis. In addition, case-based discussion and multisource feedback can be helpful [27]. In assessing technical skills, OSATS is considered the 'gold standard' [28,29]. There is a lack of simple assessment tools to measure the basic endourological training and outcomes in urology [30]. Matsumoto *et al* used a 24-point cystoscopic and ureteroscopic procedure-specific scale with a seven-point global rating scale to assess ureteroscopy skills [31]. An OSATS for cystoscopic and ureteroscopic skills with a two-point scale (correct or incorrect) for technical steps has also been proposed [32]. A good internal reliability for the global rating scale during cystoscopy and ureteroscopy on a virtual reality simulator and flexible cystoscopy on patients by seventeen urology residents has been reported [33]. Furthermore, a TURBT-specific 51-item "Test Objective Competency" (TOCO)-TURBT tool designed to assess technical and non-technical skills reported good validity and reliability [34], however, the tool is more suitable for the operating theatre environment and a large number of data points may affect compliance amongst trainers. More recently, an assessment tool for a set of exercises for cystoscopy and ureteroscopy has been validated [35]. The tool is very task and step-specific for a particular procedure and generalisation like GAUES would not be possible. The GAUES score can be useful both to give formative and summative feedback and in competency assessment [36]. We believe our tool allows task-specific and step-based global measure of endourological skills because of simplicity and applicability in multiple procedures during simulation training.

Strengths and Limitations

We have used the GAUES score routinely during the USBC with an excellent acceptance rate. In assessment of simulated ureteroscopy, we have demonstrated reliability of ICC = 0.841 which is considered excellent. Our results indicate that the

GAUES is a feasible, valid and reliable GAUES assessment tool for basic endourological skills during the simulation training. There is an option to describe the simulation model details on the GAUES tool as the fidelity of the model can affect the trainees score. We feel that our assessment tool can be used to assess trainees' progress in operating theatre settings after further studies.

There are limitations in this study. First, the lack of repeated assessment of interrater reliability. Methodological researchers have recommended the use of repeated measurement to reassess agreement [37]. Second, is the absence of assessment of ICC during TURP. Third, the evaluation is restricted to the simulation setting and the tool has not yet been assessed for training during procedures in an operating theatre. Further studies are needed to evaluate applicability, feasibility, acceptability and educational impact in the clinical setting. Further guidelines, familiarisation and expert training to use the GAUES assessment tool should improve system reliability. Another limitation is that we did not assess predictive validity. We think that the results of this assessment tool are encouraging and should be evaluated widely for replicability and applicability and may be suitable to the clinical setting as well. Patient discomfort can be measured with domain U-IT3 and awareness of radiation safety can be evaluated with U-IT9 during surgery. In addition, we plan to explore usefulness of the tool during percutaneous nephrolithotomy simulation during the next boot camp.

Conclusions

Using a modified Delphi technique, we successfully developed a simple novel assessment tool (GAUES) that can be used in simulation training. A panel of expert endourologists supported the excellent face, content and construct validity of the GAUES assessment tool during simulation training with good reliability at the Urology Simulation Bootcamp Course (USBC). Its generic framework has allowed it to become a useful method of assessment across multiple procedures and has the potential to set standards for endourological training during simulation practice in the future. We are also optimistic that this generalisability enables investigators to measure the effect that simulators and other training methods have on the acquisition of endourological skills.

Conflicts of Interest

None declared.

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Table 1

Global Assessment of Urological Endoscopic Skills

Candidate details:	**Candidate Grade**		
	Date		
	Session (circle)	**A.M.**	**P.M.**
	Assessor Name		
	Model detail		

Skill (tick)	Cystoscopy	TUR	URS
		TURP / TURBT	

Instructions: Please read each action and the performance indicators. Evaluate the performance of the trainee for each action according to the 1-5 scale listed, then record the corresponding score in the column labelled "score"

	UROLOGICAL ENDOSCOPY TECHNIQUE	**Score**
U-IT1	**Scope Navigation/Safe Advancement** 1. Not able to achieve goals despite detailed verbal guidance requiring takeover 2. Requires verbal guidance and part assistance to navigate the urinary tract 3. Requires verbal guidance to completely navigate the desired part of the urinary tract 4. Able to complete the procedure, but not like an expert 5. Expertly able to manipulate the scope in the urethra/bladder/ureter autonomously and achieve farthest landmark as appropriate	
U-IT2	**Ability to Keep a Clear Endoscopic Field** 1. Inability to maintain view despite extensive verbal cues 2. Able to maintain some view with regular prompting 3. Requires moderate prompting to maintain clear view 4. Requires occasional prompting to maintain clear view 5. Used irrigation and emptying optimally to maintain clear view of endoscopic field	
U-IT3	**Monitoring and Management of Patient Discomfort During Procedure** 1. Not applicable (bench-top model during simulation setting) 2. Does not recognise discomfort or requires prompting to act 3. Recognises pain, but does not address problems in a timely manner 4. Recognises pain, but management not like an expert	

	5. Proactive assessment and management of comfort during the procedure	
U-IT4	**Landmark Recognition/Familiarity with Instrument** 1. Generally unable to recognise most landmarks in a model/clinical setting 2. Recognises some landmarks but no perception of instruments and pathology 3. Recognises some landmarks but generally poor perception of instrument /pathology location 4. Recognises landmarks with moderate perception of instrument/pathology 5. Able to recognise all landmarks and clear idea of instrument/pathology location in relation to landmarks	
U-IT5	**Quality of Examination/Visualisation Mucosa/Urothelium** 1. Could not perform a satisfactory examination despite verbal and manual assistance requiring takeover of the procedure 2. Could perform a satisfactory examination with lots of verbal and manual assistance 3. Able to visualise much of the mucosa but requires direction to re-inspect missed areas 4. Good visualisation, but not like an expert 5. Good visualisation and spends appropriate time on withdrawal	

U-IT6	**Pathology Identification/Interpretation** 1. Poor recognition of abnormalities (misses or cannot identify significant pathology) 2. Recognises pathology with help but cannot interpret 3. Recognises abnormal findings but cannot interpret 4. Recognises abnormal findings but interpretation with help 5. Competent identification and assessment of abnormalities	
U-IT7	**Therapeutic Tool/Laser/Access Sheath/Stent Selection** 1. Not applicable 2. Unsure of possible tool/s indicated for pathology 3. Able to identify possible appropriate tool choices but not sure which would be ideal 4. Able to identify tools and settings but with some guidance 5. Independently identifies correct tool and settings as applicable	
U-IT8	**Ability to Perform Therapeutic Manoeuvre (TURP/stone fragmentation/TURBT/coagulation of tumour with diathermy during flexible cystoscopy)** 1. Not applicable	

	2. Performed with significant hands-on assistance 3. Performed with minor hands-on assistance or coaching 4. Performed independently with verbal guidance 5. Performed independently without coaching and takes necessary precautions to avoid complications	
U-IT9	**Ability to Use Fluoroscopy** 1. Not applicable/unsafe 2. Below expectation 3. Borderline 4. Meets expectation 5. Above expectation	
	GLOBAL ASSESSMENT	**Score**
GA-1	**Trainee Hands-On Skills are Equivalent to those of a:** 1. Novice (learning basic scope advancement; requires significant assistance and Coaching) 2. Intermediate 3. Advanced 4. Competent to perform routine cystoscopy/ureteroscopy independently	
GA-2	**Trainee Cognitive Skills (situational awareness (SA)/Abnormality Interpretation/Decision Making Skills) are:** 1. Novice (needs significant prompting, correction or basic instruction by trainer) 2. Intermediate (needs intermittent coaching or correction by trainer) 3. Advanced (trainee has good SA and interpretation/decision making skills) 4. Competent to make decision and interpretations independently	

Final Assessment

Level 1	Insufficient evidence observed to support a summary judgement	
Level 2	Unable to perform the procedure, or part, observed or under supervision	
Level 3	Able to perform the procedure, or part, observed or under supervision	
Level 4	Able to perform the procedure with minimum supervision (needed occasional help)	
Level 5	Competent to perform the procedure unsupervised (could deal with complications that arose)	

Figure 1: A bar chart demonstrating responses by experts for each domain on the GAUES assessment tool (N=9) “global” applicability.

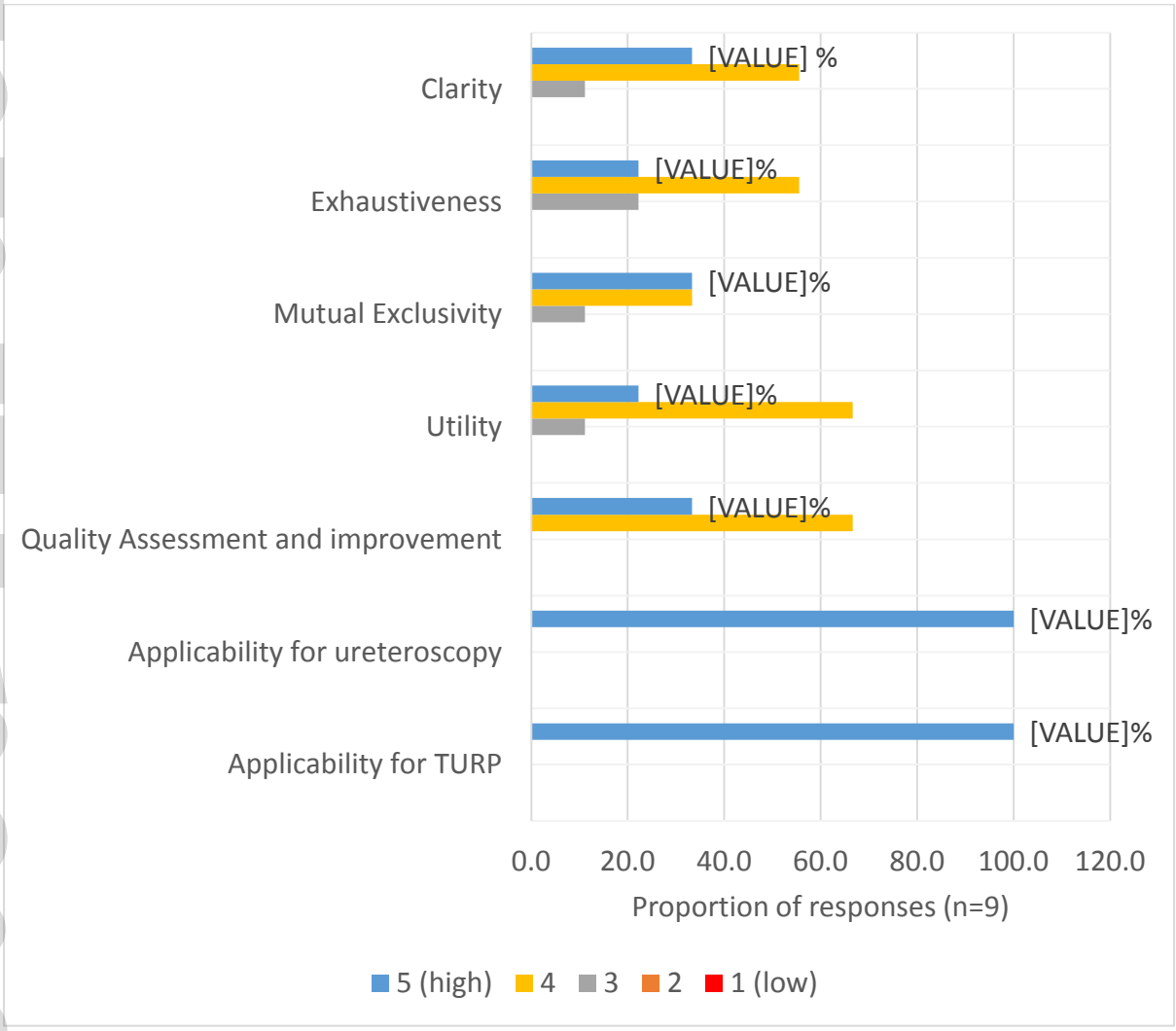

Figure 2 GAUES Scoring compliance by experts for ureteroscopy and transurethral procedures

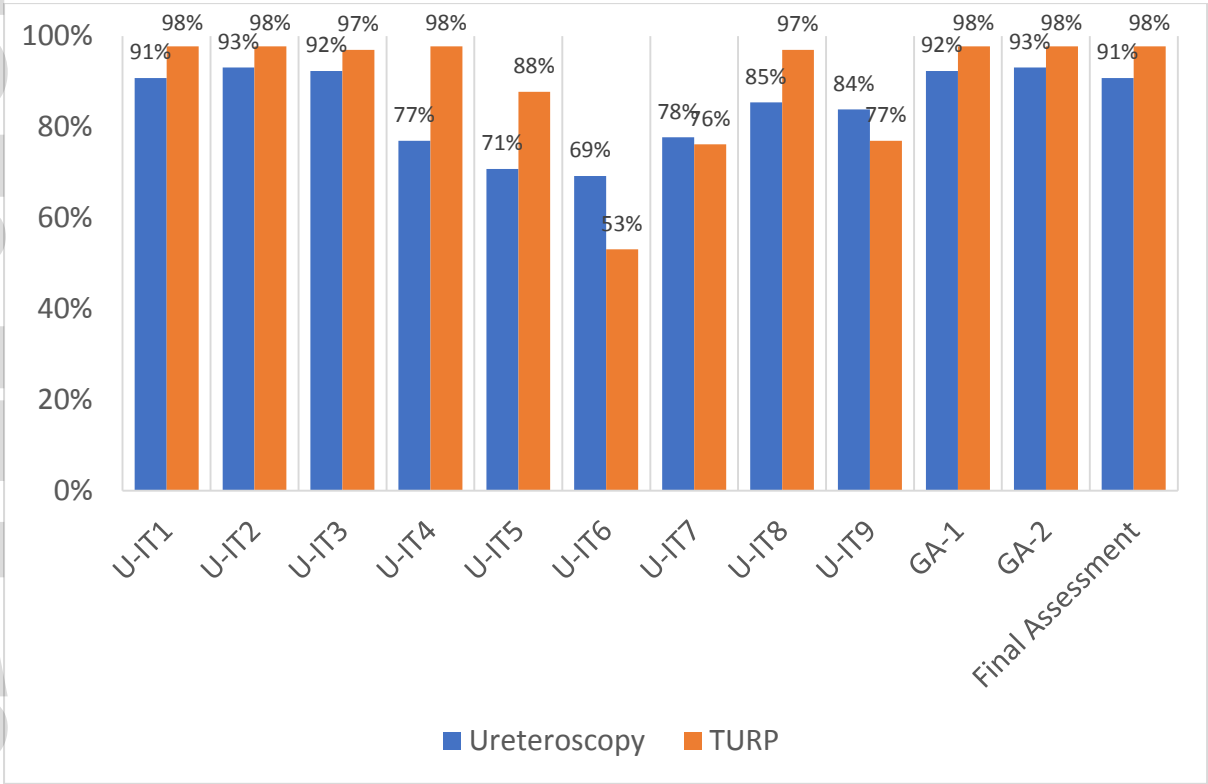

Figure 3: GAUES Assessment tool for Ureteroscopy (Box-whisker plot). The largest improvement pre and post training was seen in U-IT7, with a median one-point increase in performance for trainees.

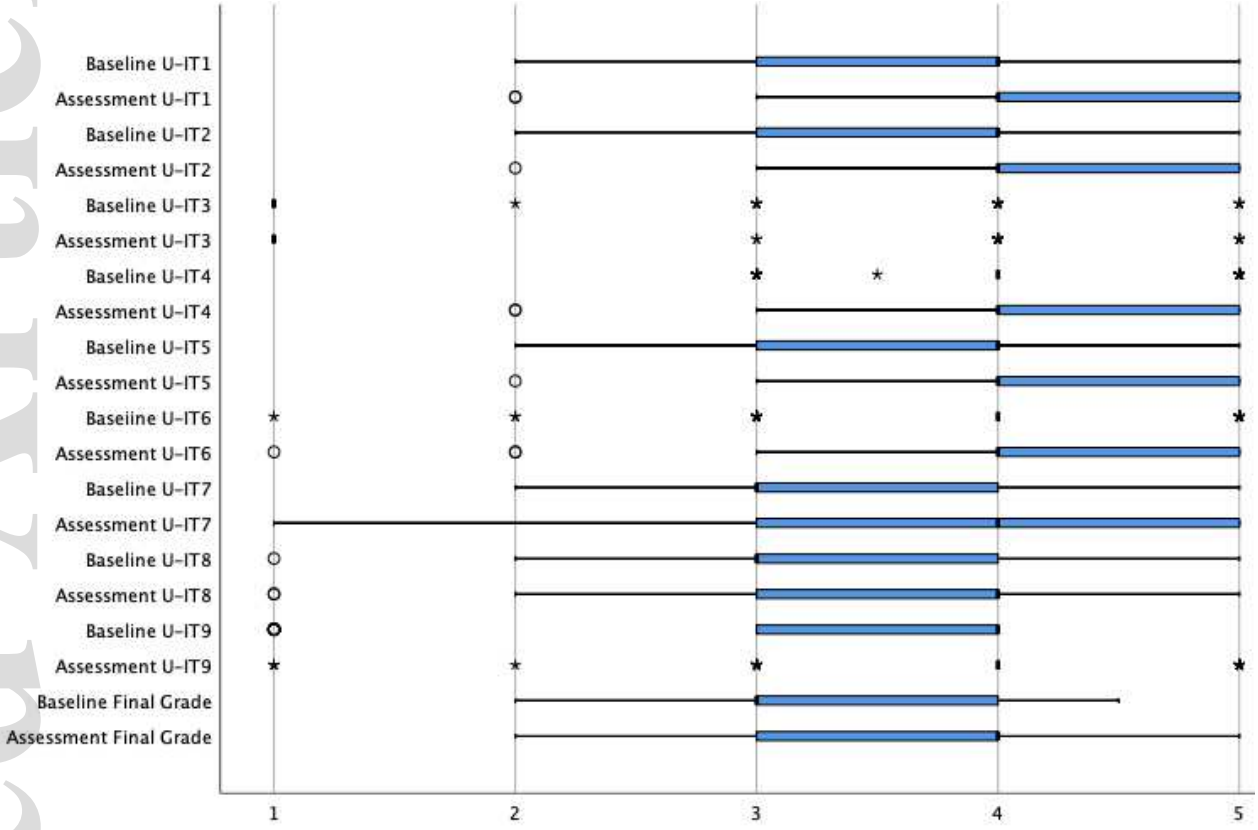

Figure 4: GAUES Assessment tool for TURP (Box-whisker plot).